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FLOOD MITIGATION WORK IN NEW SOUTH WALES

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FLOOD MITIGATION WORK IN NEW SOUTH WALES

1. The State of New South Wales (Figure 1) extends 756 miles in an east-west direction and 683 miles from north to south. The Great Dividing Range, which divides the State into two regions, is generally about 3,000 ft to 4,000 ft in height, reaching a maximum of over 7,000 ft in the south. Ground levels fall sharply toward the east and a coastal plain containing many swampy areas and up to about 40 miles in width is found along much of the coastline. About 200 miles from the coast the western slopes give way to land which is fairly flat with a gradual fall westward.

INCIDENCE OF RAINFALL AND FLOODING

2. Isohyets of average annual rainfall are shown on Figure 1, from which it will be seen that this average varies from 70 in near the coast to only 8 in in the western part of the State. The yearly rainfalls vary considerably from the average; for instance the total annual flow in the Darling River has been known to vary from as little as 18,100 ac ft to as much as 23,643,600 ac ft. The intensities in some coastal streams vary from practically nothing to more than 500,000 cusecs. Although snowfalls occur along the Great Dividing Range there is no reliability of occurence of either snowfall or time of snow melt. No particular cycle of rainfall or flooding occurs within the State.

LOSSES CAUSED BY FLOODS

3. Although the consequences of flooding in the earliest years of occupation were such that the Administration had difficulty in providing sufficient food for the population, considerable settlement did proceed on the flood plains of many rivers with the result that numerous towns are situated in areas liable to floods.

4. Since much of the primary production of the State depends on the use of the generally highly productive flood plains, floods often cause serious losses in crops and livestock and, at times, destruction of good farming lands.

5. There have not been any extensive surveys of damage caused by flooding to enable a close ecomonic investigation of the many schemes which have been evolved from time to time for mitigating the effects in this State. Very rough estimates of direct losses due to flooding are often made when floods occur and, although it is doubtful whether these estimates could be used in an economic survey, they do serve to

indicate the order of losses suffered. For instance, after a major flood in the Clarence River in 1950 it was estimated that losses would amount to £A1,500,000, and after the serious flooding, simultaneous in several river valleys, in 1955 the damage caused was estimated at £A15,000,000.

6. These figures refer to damage caused by major floods, but much damage is also caused by minor but more frequent floods. This is of a permanent nature, such as destruction of land by washing away of top soil, gulley erosion and stream bank erosion.

7. Damage by stream bank erosion is particularly severe on the Hunter River, where alluvial lands with soils up to 40 ft in depth are being lost by this means. An indirect result of this erosion is the high cost of dredging necessary to maintain adequate water depth in Newcastle Harbour at the mouth of the river.

8. Regular dredging of Newcastle Harbour was commenced more than 100 years ago and the total quantity of material removed since then is in excess of 175,000,000 tons, the average over each of the last ten years being 3,500,000 tons, at an average annual expenditure of over £A300,000.

9. Floods also cause loss of human lives; fourteen were lost in the Hunter Valley during the 1955 floods.

FLOOD MITIGATION STORAGES

10. Among the investigations made for measures to mitigate flooding, the use of dams has received much attention, but only one major dam primarily for flood mitigation has been authorised for construction by the State and even that work has not yet been commenced.

11. On some coastal streams, principally the Richmond, Clarence and Macleay Rivers, sites for dams have been examined and estimates of the cost and effects which could be expected on known floods have been determined; but in all cases, it has been found that the cost-benefit ratio, as far as this could be determined from the information available, would be too high to warrant construction.

12. The one authorised dam to be used primarily for flood mitigation is to be located on a tributary of the Hunter River that has made a major contribution to flooding in the lower reaches of the Hunter. It will have a storage capacity of 406,000 ac ft of which 335,000 ac.ft is for flood mitigation. This will be sufficient to retain a run-off averaging 9.3 in in depth over the whole of the catchment above the dam.

13. In carrying out investigations into the construction of two water conservation dams, viz., Glenbawn Dam and Burrendong Dam, the latter still under construction, it has been found that by raising the height of the dam and also the spillway level, but not increasing the conservation storage capacity, a considerable volume of flood mitigation storage is obtained at practically no cost because of savings effected in the cost of the spillway.

14. The flood mitigation storage of 108,000 ac ft in Glenbawn Dam will retain an average of approximately 4.5 in of run-off from its 500 sq mile catchment, this being equal to the highest run-off ever recorded from this catchment. Whilst the dam can be expected to have a considerable effect on flood heights in the upper reaches of the Hunter River, its

effect in the lower reaches will be very small because it will control only a small proportion of the total catchment of over 8,000 sq miles.

15. A flood mitigation storage of 397,000 ac ft in Burrendong Dam will hold an average run-off of approximately 1.4 in from its catchment of 5,360 sq miles and is expected to have a considerable influence on flood heights along the river for a distance of 50 to 80 miles, although this could depend, to some extent, on methods of operating gates to be installed in the dam.

SOIL CONSERVATION WORK

16. The use of mechanical soil conservation work to stabilize eroding areas has been adopted generally over the past 25 years and the area on which it has been carried out in the State now exceeds 1,150,000 ac. It has been said that this type of work, by holding rainfall on the land and slowing its passage to the stream, is a major flood mitigation measure.[2]

17. The degree to which soil conservation work can mitigate flooding must be related to the proportion of the rainfall it can intercept, the relative locations of the area treated and the area which is flooded and the effect retention of additional water will have on flood hydrographs.

18. Whilst soil conservation work in the lower rainfall areas of the State would undoubtedly have a substantial effect on discharge from the areas treated, the effect is less certain in the higher rainfall areas and particularly on the coastal streams, where it is not uncommon for a rainfall of up to 20 in to occur within a period of four days.

19. Arising out of a proposal for the implementation of soil conservation work on approximately 2,000,000 ac of land within the Hunter Valley as a means of mitigating flooding along that stream, a trial is at present being conducted to examine the effectiveness of this type of work for flood mitigation. It has been stated that this work will retain an additional 1.75 in of rainfall (on the area treated) but it is necessary to determine whether this will be so and what effect retention of additional water will have on flood flows.

20. One of two somewhat similar catchments is being treated, the construction work being now well advanced, as also is instrumentation of both catchments to obtain measurements of rainfall and run-off from both so that the effect of the works can be evaluated. The work being done is costing approximately £A5 per acre of treated land. Because of the need to wait until the occurrence of sufficient rainfalls of high intensities provides results for analysis, it could be several years before any decisive results are available.

RIVER IMPROVEMENT

21. Improvement of river channels has been undertaken to increase their flood carrying capacities and to prevent or minimize damage such as stream bank erosion.

22. Some streams have had their flood carrying capacities considerably reduced by encroachment of vegetation, mainly willows which were imported into the country about 150 years ago. Stream clearing has been undertaken over a 50 mile length of the Tumut River, the expenditure averaging approximately £A5,000 per mile.

2 Kaleski, L.G., Erosion and soil conservation in the Hunter Valley Soil Conserv. N.S.W., 18, 2 - 9, (1962).

Table 1 shows the increased capacities obtained at two locations on this stream.

TABLE 1

Stage	Site 1			Site 2		
	Discharge in Cusecs		Increase on Original	Discharge in Cusecs		Increase on Original
	Before Clearing	After Clearing		Before Clearing	After Clearing	
1 ft	500	1,000	100%	1,050	1,400	33%
2 ft	1,150	2,250	95%	1,600	2,150	34%
3 ft	1,900	3,500	84%	2,050	2,900	41%
4 ft	3,000	4,700	56%	2,600	3,800	46%
5 ft	4,600	(not		3,050	4,700	54%
6 ft		gauged)		3,600	5,600	55%
7 ft				4,250	6,500	53%

23. Similar work has been carried out on other streams, but information as to increases in capacities obtained is not available.

24. Work to minimize losses by stream bank erosion has been carried out on numerous streams throughout the State, most intensively in the Hunter Valley[3] where more than 70 miles of stream have been treated at a cost averaging about £A10,000 per mile.

LEVEES

25. Levees have been used as a defence against floods for nearly 100 years but the early works were mostly small and sporadic and were frequently outflanked or overtopped.

26. On a number of inland streams levees completely encircling flood liable towns have recently been constructed, or are contemplated, by State and Local Government agencies and, whilst access to these towns will frequently be cut by floodwaters, it is expected that evacuation of, as well as loss and damage by inundation within, the town area will be avoided. In one case an airfield servicing the town has been included within the protected area to maintain communications.

27. Proposals have been developed,[4] and are in course of implementation, whereby on coastal rivers flows will be confined to river banks up to predetermined flood stages, after which overtopping of specific sections of levees will occur and surplus water allowed to flow through selected floodways to avoid indiscriminate flooding within the flood plain. Subsidiary levees will be used in flood channels to cause build up of tailwater against levees which are overtopped and so reduce the possibility of breaching.

28. An important element of these schemes is the rapid drainage of floodwaters from the flood plain as the river subsides, necessitating

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3 Reddoch, A.F., River control work in the non-tidal section of the Hunter River and its tributaries, J. Instn. Engrs. Aust. 29, 241 (1957).
4 Harrison, E.W., Flood mitigation on the Lower Hunter River N.S.W., J. Instn. Engrs. Aust., 29, 321 (1957).

the construction of drains with flood gates installed where water re-enters the river channel.

FLOOD FORECASTING AND FLOOD WARNING

29. Efforts to forecast the heights likely to be reached by floods have been made over a long period of time, but until recently these have mostly been made by non-technical personnel and based on stream heights farther upstream.

30. The time of concentration of floods at critical points varies from a few hours on coastal streams to weeks and even months on some of the inland streams.

31. On some streams, viz., the Macleay, Hunter and Lachlan Rivers, where the time of concentration at critical points is short, technical personnel are used to prepare estimates of flood heights based on recorded and expected rainfalls and assessments of run-off which these rainfalls will produce, as well as any stream height information which can be used. The methods being used[5, 6] are based on the unit graph-loss rate procedure, the principal difference between specific cases being the method of determining loss rate. Extension of this work to other rivers is contemplated.

32. The development of these systems has necessitated the improvement, extension and supplementation of existing communications and the allocation of specially trained staff to the work.

33. Whilst preparation of flood forecasts is undertaken by government authorities in respect of certain predetermined locations along the river valleys, the interpretation of these forecasts to determine local effects and the dissemination of this information, usually by radio, is arranged by local bodies or committees specially set up for that purpose.

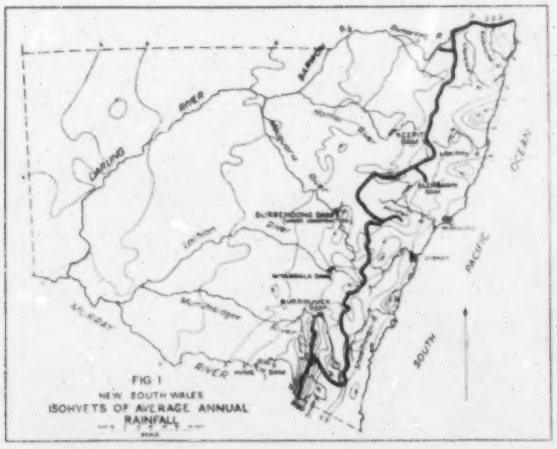

Figure 1- isohyets of average annual rainfall.

5 Watson, B., The development of a flood forecasting system for the Macleay River at Kempsey, N.S.W., Commonw. Bur. Meteor. Work. Pap. 59/2854, Sydney, (1962)

6 Tipping, A.J., and Davidson, D.E. Flood forecasting in relation to Wyangala Dam on the Lachlan River. J. Instn. Engrs. Aust. (in press, 1962)

1341 E - Nov. 1962 - 1, 60